IN WISCONSIN.

By J. E. LOCKWOOD, Meteorologist.

[Weather Bureau, Milwaukee, Wis., March 16, 1922.]

This sleet and glaze storm will go down in the climatological history of Wisconsin as the most remarkable, most spectacular, and most destructive storm of the kind that has visited the State since the taking of systematic weather observations was begun.

In the northern half of the State the precipitation was in the form of snow and, added to the amount already on the ground, made depths of 20 to 50 inches on the level and drifted to great heights. In the southern half of the State it fell as rain, but most of the time during that period surface temperatures were below freezing, and the rain froze after it had fallen on trees, wires, and other surfaces, the ice accumulating to such thickness as to bear down, with its unusual weight, electric wires and poles and great branches of trees.

WHERE THE HEAVIEST DAMAGE OCCURRED.

Figure 1 shows where the damage to telephone and telegraph lines, interurban trolley lines and electric

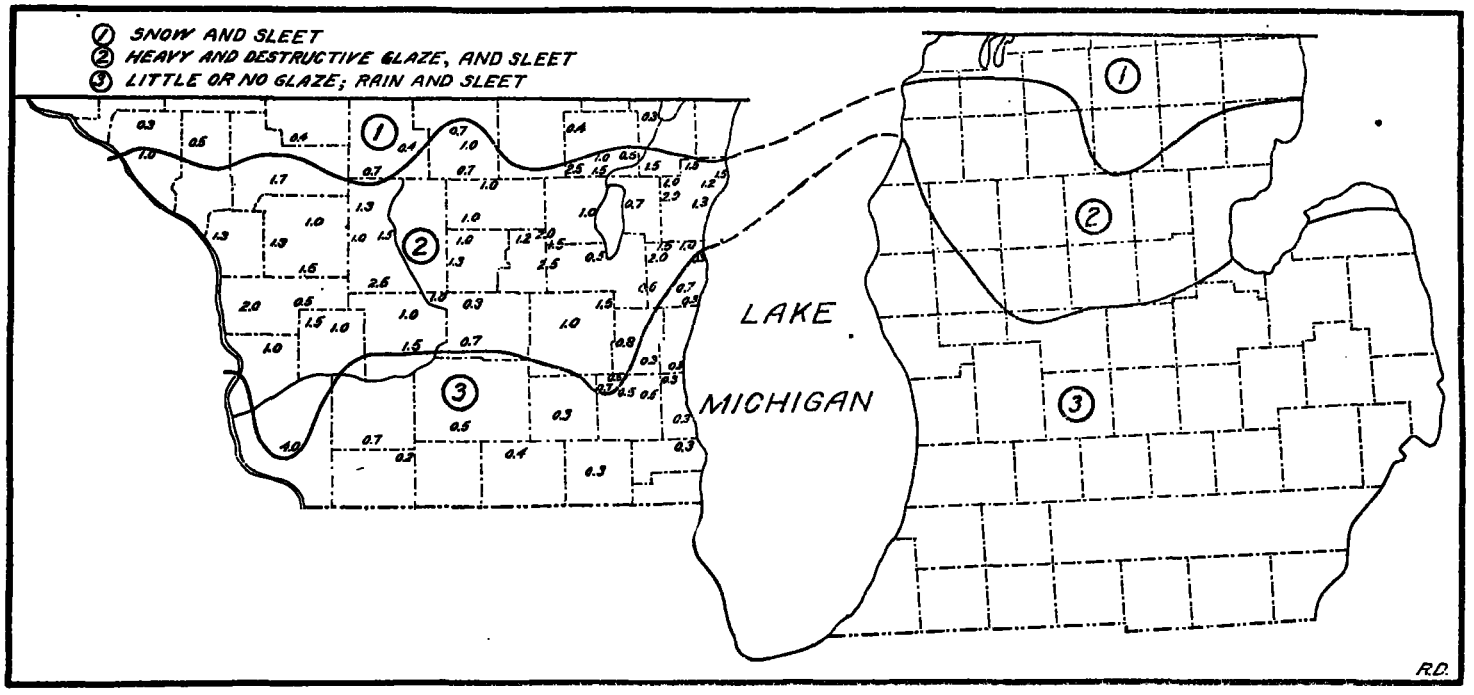

FIG. 1.—Portions of Wisconsin and Michigan in which glaze was formed, and in which the precipitation fell as rain and snow.

By noon of the 22d, the ice burden had become so heavy that wires were beginning to pull and break. By night, practically every circuit was broken in many towns in the heavily glazed area. Trees and poles continued to fall all through the night and during the 23d, and streets were badly littered and blocked to traffic in many places. Wires were a tangle and there was danger of electrocutions.

SLEET.

Along the border line between the areas of rain and snow, respectively, the rain drops froze before reaching the ground, forming sleet which accumulated to unusual depths. It was described by some of our cooperative observers as quoted below:

Mr. Carl Stange, Neillsville: "The sleet was like coarse rock salt." Mr. W. H. Scott, Stanley: "Much of the precipitation came in the form of small hailstones. It was just like a bed of shot to walk in." Mr. C. G. Stratton, River Falls: "The precipitation was mostly frozen rain; the ice fall was perfectly dry and made progress difficult. Each step splashed the pellets away, after which they closed in again. They were one-sixteenth to one-tenth of an inch in diameter. On sidewalks and in roadways and other depressions, the pellets accumulated as deep as 10 to 12 inches. The average depth was around 2 inches. When melted it made 1.10 inches of water." Mr. E. F. Stoddard, Downing: "The ice granules that fell on the night of the 21st, to a depth of 6 inches, practically stopped all traffic."

Weight of the ice.—To form an estimate of the great weight the wires, poles, and trees were called upon to bear, the following may be cited:

At Oshkosh a small piece of ice-covered branch was found to weigh 2 pounds. Without the ice it was found to weigh 2 ounces, or one-sixteenth of its former weight. At Ripon a similar test was made, using a large branch, and it was found that the ice had increased the weight of the branch to twenty times its normal weight. One man reported that a 6-inch twig, weighed by him, tipped the scales at 2 pounds. At Wild Rose a section of wire, 1 foot long, was cut and its weight determined as 1¼ pounds, and at Camp Douglas 1 foot of telephone wire weighed 2 pounds.

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FIG. 2.—Showing icicle fringe on telephone wires and fences. (Courtesy of *Milwaukee Journal.*)

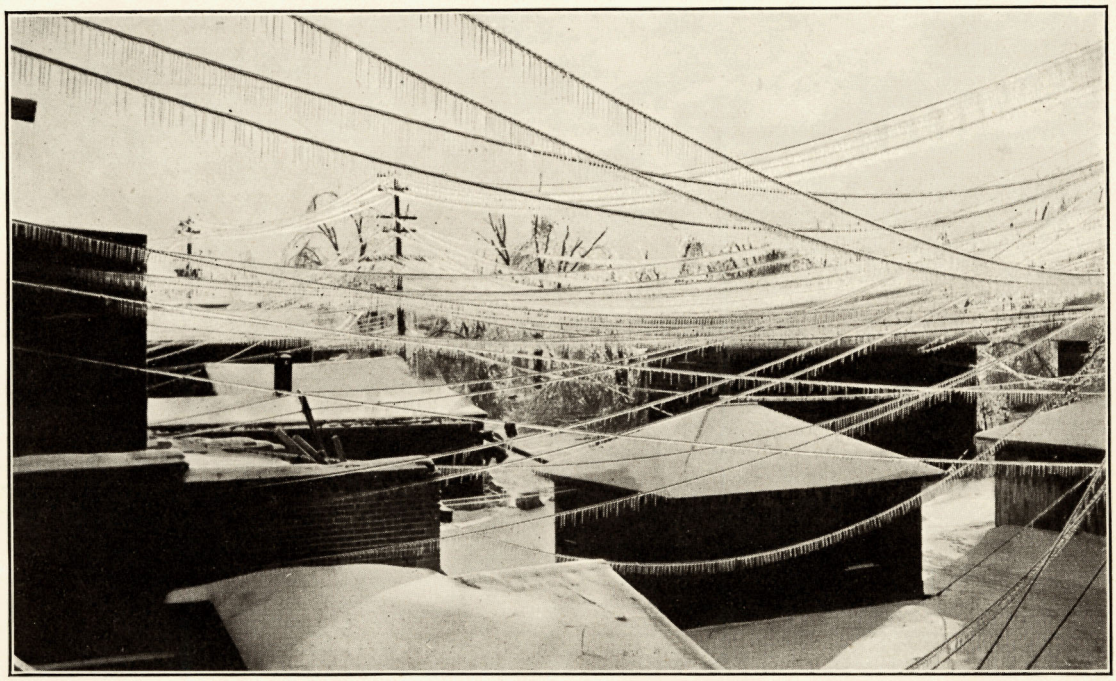

FIG. 3.—Ice cover and icicle formation at Tomah, Wis.

Mr. E. C. Thompson, observer in charge of the Weather Bureau office at La Crosse, is quoted as follows: "The ice-covered wires were as thick as your wrist. One lineman took ice from 3 feet of wire and it weighed 12 pounds. A man in Sparta weighed a small branch from a tree and then, knocking all the ice off, found that it weighed one-sixteenth of its original amount." (See Fig. 4.)

As telephone poles are usually spaced 130 feet apart and carry 40 wires, 1 pound of ice to the foot would put an additional weight on the poles of 5,200 pounds to the span. When a branch of a tree, overcome by from 10 to 16 times its usual weight, fell across these wires, they broke readily, and the poles, released of the balancing weight on one side, fell in the opposite direction, going down one after the other, like a row of dominoes. Often 2 or 3 miles of poles went down at one time. In one stretch of 6 or 7 miles every pole was down when the storm was over. At least 15,000, and more likely 20,000, poles were down when the storm was over, and telephone, telegraph, and light and power service was interrupted for from 2 to 15 days.

Where the poles held upright the wire stretched and sagged almost to the ground in many places. Most of the wire was rendered useless and will have to be discarded and new wire run in its place. The financial loss to telephone and telegraph companies was consequently very great, amounting in many instances to one-half of the investment.

Timber, fruit, and shade trees were severely damaged and a considerable percentage of them completely destroyed. Near La Crosse large fir trees were stripped of every limb and stood like tall masts. Shade trees lost large branches and many had to be cut down. Fruit trees were bent and broken by the weight of the ice or split through the middle by the branches bending to the ground in opposite directions. These latter were, of course, destroyed and they represented in a few places in the Fox River Valley as high as 40 per cent of the trees. In the Kickapoo Valley many apple orchards were badly damaged, but the percentage was not so high as in the Fox River Valley and was confined mostly to the ridges, while in the valleys the trees escaped severe damage.

Winter grains and grasses were injured by smothering, caused by the heavy coating of ice on fields and meadows.

THE CENTER OF DESTRUCTION.

The Fox River Valley and counties bordering on Lake Winnebago was the center of destruction, while in a belt 75 miles wide, extending westward to the Mississippi River, the damage was only slightly less severe.

Within this belt there are about 1,000,000 apple trees, but it is impossible to reliably estimate the financial loss caused by the damage to these orchards. The chief financial loss fell upon telephone, telegraph, and electric power companies. Independent farmers' telephone lines were hard hit and many of these companies lost nearly their entire outside equipment. Power plants lost many miles of poles and lines, and many manufacturing plants, depending upon them for power, were shut down for from two to five days. Cities depending upon them for light were without service for nearly a week.

COMMUNICATION CUT OFF.

Communication, except by wireless, with many cities within the heavily glazed area, was entirely cut off for 24 hours or more and all electric service seriously curtailed for from one to two weeks. Cities were in darkness by the night of the 22d, because of broken service wires, and all electric power had to be cut off to avert danger from live wires. The city of Oshkosh was without lights two nights and the fire-alarm system was out of order for two or three days. Neenah, Menasha, Appleton, and Fond du Lac were under similar conditions and the entire valley from Kaukauna to Fond du Lac was living in a primitive mode, as to light and transportation, for nearly a week.

TRANSPORTATION STOPPED.

Interurban electric lines were unable to give service for periods varying from two to three days to as many weeks. Between Little Chute and Appleton all trolley poles were down. The line from Oshkosh to Neenah was not in operation two weeks after the storm had passed.

Railroads suffered a very severe tie-up, the roads being blocked in the north by the great drifts and in the middle counties by heavy ice on the tracks. From Oshkosh nearly to Green Bay and in near-by counties the railroads had to resort to pick and shovel to remove solid ice from the tracks, a very laborious and time-consuming process. Most cities in all but the southern counties were without any train service whatever from one to two days, and at some places the blockade lasted a full week.

FLOODS.

Ice jams on rivers and the rapidly melting ice caused minor floods at Sheboygan, La Crosse, Darlington, Fond du Lac, and a suburb of Milwaukee. These caused considerable inconvenience but little monetary loss.

ESTIMATE OF THE LOSS.

From replies to inquiries sent to nearly 200 towns in the State an estimate of the loss to telephone, telegraph, and electric power companies by the prostration of their lines is placed at $8,000,000. A total loss of $10,000,000 in Wisconsin to all interests caused by this severe storm would be a conservative estimate.

THE WORK OF RESTORATION.

Two weeks after the storm had passed, the work of restoring electric circuits was still going on in the city of Oshkosh. Most of the electric service had been put in operation, but the street lights were not yet restored. Telephone service with other cities was complete but of a temporary character. The city of Fond du Lac was just recovering from the effects of the storm, which had been aggravated by a rise of the Fond du Lac River. This was caused by the rapidly melting ice, and streets were flooded over nearly three-fourths of the city.

It will be several months before telephone and telegraph lines are back to normal conditions.

CASUALTIES.

Fortunately, only two deaths resulted from the storm in this State. A fireman of Manitowoc was overcome by smoke while fighting a fire caused by crossed wires. A child was drowned when Keith Creek rose above its bank, near Beloit, Thursday the 23d.

Two engineers and two firemen were severely injured when the two engines, hauling a passenger train, were wrecked by heavy snow at Little Chute. In three other

derailments caused by the storm, trainmen were slightly injured.

EXCEPTIONALLY HEAVY RAINFALL.

The great destructiveness of this storm was the result of circumstances very favorable for the formation of glaze. One of the heaviest rainfalls ever known in this State, at this season of the year, fell slowly through a period of nearly 48 hours during which surface temperatures remained below freezing.

On trees the ice accumulation was almost entirely on the windward side. On the wires, the ice cover turned on the wires as the weight became unevenly distributed, and thus became nearly uniform in thickness until icicles began to form. This formation is shown very clearly in one of the accompanying photographs.

IN MICHIGAN.

By D. A. SEELEY, Meteorologist.

[Weather Bureau, Lansing, Mich., March 23, 1922.]

Probably the worst ice and sleet storm and one of the heaviest snowstorms on record in Michigan occurred February 21–23, 1922. Millions of dollars worth of property was destroyed. Railroad service was paralyzed and wire communication was cut off over a considerable portion of the northern half of the State for several days.

Reports received from the regular Weather Bureau stations, Wednesday morning, February 22, told of heavy snow in the northern portions of Wisconsin and Michigan with temperatures about 18° to 25°, and rain with thunder and lightning in southern Michigan, where the temperature was about freezing. Wires were down in the northern counties of the lower peninsula, due, as it was found later, to the fact that an exceedingly heavy coating of ice had accumulated on them and borne most of them to the ground.

At a number of stations in the north-central portion of the lower peninsula the amount of precipitation exceeded 4 inches. These stations were in the region where the precipitation was in the form of sleet or rain which froze as it fell and formed a solid sheet of ice. This ice coating was so thick and heavy that it broke off many branches of trees, even those of considerable diameter, and practically denuded all trees of smaller branches and twigs. In many orchards from 25 to 75 per cent of the older trees were broken off entirely. Younger orchards were injured somewhat less. Wood lots and shade trees were seriously damaged. Telegraph, telephone, and high-tension electric lines were borne to the ground and thousands of poles and supporting towers were broken off. For many miles along some of the railroads every pole was prostrated.

A number of reports were received giving definite weights of the coating of ice on twigs and wires. At East Tawas, Mich., a length of No. 14 telephone wire, 1 foot long, with its ice coating, weighed 11 pounds and the measurement was not made until a week after the storm had passed and undoubtedly considerable had melted and evaporated before it was weighed (see fig. 4). At Omer, Mich., the thickness of the ice coating was 4 inches. At Arcadia, a short twig weighing 1 ounce had an ice coating of 2 pounds. A larger twig about the size of a lead pencil supported a column of ice 9 inches in circumference. Several observers reported the ice coating to have weighed 20 to 40 times as much as the supporting branch or wire. The weight of ice on six high-tension electric cables between two supporting towers of the Consumers' Power Co. near Cadillac was computed by competent engineers to exceed 1½ tons. (See fig. 7.)

The area included in the region of heaviest ice coating, as shown by figure 1, is bounded on the west and south by a line starting just north of Manistee, on the Lake Michigan shore, running southeastward through northeastern Mason and Newaygo Counties to southern Mecosta County, thence eastward through northwestern Saginaw County, and northeastward to Bay City. The northern boundary of the heavy damage extended from Frankfort, Mich., eastward across Benzie and Grand Traverse Counties, thence southeastward to southern Roscommon County and northeastward to the town of Oscoda on the Lake Huron shore. A few sections outside of this area also reported heavy damage, including the extreme northern portions of Otsego and Huron Counties.

As to the amount of damage done, the following statements might be made. In one orchard north of Manistee containing 45,000 trees, 50 per cent were reported as destroyed and will have to be cut away and replaced. In other smaller orchards a little farther north, from 50 to 70 per cent of the trees were destroyed. One of the larger telephone companies in the State, operating in the stricken region, reports an estimated loss of $400,000. A number of smaller companies were a complete wreck and in at least one case bankruptcy has followed and the line will not be rebuilt. A great many high-tension electric wires carried on steel towers were broken down and towers crumpled, one company alone losing 200 towers. The damage to wood lots, shade trees, etc., can not be estimated. A number of towns were left in total darkness for days after the storm. Train service was impossible not only on account of the ice coating on rails, but because all wires were down and it was impossible to issue orders over them. The roofs of many buildings collapsed under the heavy load of ice which weighed 16 to 20 pounds per cubic foot.

It seems probable that the total value of property destroyed and the damage to various industries due to the stopping of transportation, etc., will exceed $5,000,000.

A few quotations from reports received will give a better idea of the storm.

Benzonia, Mich.: "The damage is hard to calculate, but at least one-third of the growing timber is destroyed."—Wallace Nutting.

Morley, Mich.: "The storm was the most severe and destructive in Michigan during my stay here of 28 years. I had a forest of sugar maples, black cherry, beech, and elm, which I considered very valuable, and the destruction to it was almost complete."—W. F. Giddes.

East Tawas, Mich.: "The ice storm of February 21–22 last was the worst that has ever been experienced in this region."—R. G. Schreck, forest supervisor.

Hemlock, Mich.: "The sleet storm on February 22 did much damage to fruit trees, etc. I would estimate the damage in this township of $10,000."—A. C. Fehn, highway road commissioner.

Frankfort, Mich.: "A conservative estimate of damage to orchards in this township would be $5,000."—John C. McKinnon.

Lake City, Mich.: "Old orchards about 75 per cent ruined, shade trees badly damaged, young orchards damaged 5 to 20 per cent. I should judge that between $50,000 and $75,000 damage resulted in Lake City and vicinity."—Charles E. Taylor.